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ABSTRACT

A study was conducted to find a manipulation that could be performed on a text (roughly analogous to real instructional material) which would lead readers to process that text more efficiently. One-hundred five college students were placed into either an experimental or a control group. Students in the control group were given an unchanged version of a text while those in the experimental group received an elaborated version of that text. Students in both groups were told to read the text in order to prepare themselves to perform one of three tasks. The task sets were (1) a closed problem set, (2) an open problem set, and (3) a story set (a simple retelling of the story). The students were told to read the whole text through twice. Following the reading, the students rated the text and their expected tasks for difficulty and interest and were given a sentence verification test. The results showed that readers receiving an elaborated text devoted less time to their second readings. However, even though their reading rates were faster, their text recall and comprehension were improved over that of the control group. The effects of text elaboration were analogous for subjects in each of the task sets. (FL)

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The Effect of Semantic Elaboration on Reading and Comprehension

Paper to be presented at the meetings of AERA, 1981

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The Effect of Semantic Elaboration on Reading and Comprehension

The purpose of the study being discussed here was to find a manipulation which could be performed on a text roughly analogous to real instructional material which would lead readers to process that text more efficiently. The text used had as its central portion a description of the "Tea Ceremony Problem," (Hayes and Simon, 1974) an isomorph of the well-known Towers of Hanoi Puzzle. This version of the puzzle involves specifying a move sequence for transferring five tasks among the participants in a ritual, subject to constraints related to the nobility ordering of the tasks. The description of the puzzle is embedded in a discussion of a dilemma faced by some anthropologists, who wish to ensure the continuation of the ritual without changing its nature through their intervention. This text is appended to the present paper.

Two versions of the text were created. In the elaborated version, the description of the rules of the Tea Ceremony Puzzle were "semantically elaborated" by adding sentences which justified or motivated those rules in terms of their supposed social purposes or functional meanings in the ritual. For example, where the puzzle rule was "Passing rice cakes is more noble than fanning the flame," the

elaborative sentence was "It is considered more noble to warm the body from within than without." Similarly, the constraint that a ceremony participant cannot request a task nobler than the least noble task he is performing is motivated in terms of social climbing. Except for seven additional sentences in the elaborated version, involving two of the text's eight paragraphs, text versions were identical.

In my experiment, two groups of 105 students at the University of Colorado were given one of the text versions with instructions to read it in order to prepare themselves to perform one of three tasks. The task sets used were: solve the Tea Ceremony Puzzle (closed problem set), solve the problem faced by the anthropologists (open problem set), retell the story (story set). Equal numbers of subjects within each group received each set. Instructions and text were presented one paragraph at a time in a self-paced procedure on a computer CRT. The time to read each paragraph was recorded. (Note that for the two groups reading time can be compared for paragraphs which are identical for the two versions as well as for those which differ.) Subjects were instructed to read the whole text through twice. This was done because it was felt that second reading times would be most sensitive to differences in processing strategies as well as yielding information about the representation of the text constructed

during the first reading. Only after reading the whole text could subjects make informed judgements about allocation of reading time.

After the two readings, all subjectswere required to rate both the text and their expected task for difficulty and interest. Then all subjects were given a surprise sentence verification test. The 64 sentences used differed orthogonally in whether they were true or false, required only memory of explicit statements in the text or inferences from them, and in whether or not they related to the rules of the Tea Ceremony (recall that the elaborative sentences involved only puzzle rules). In no case was knowledge of information contained only in the additional elaborative sentences required for correct verification. Inferences not related to the puzzle rules dealt mainly with the behavior and values of the characters and society introduced in the text. All of these inferences were pragmatic rather than logical (necessary); for example, "The anthropologists consider the continuance of the Tea Ceremony important to their field." Inferences related to the puzzle followed logically from the rules if a correct and consistent representation of the problem had been formed, for example, "A person whose only task is stoking the fire may request no other task."

It is recognized that sentence verification falls short of being an ideal task for revealing the most interesting aspects of understanding or knowledge representation.

Nevertheless, it was selected because it yields unambiguously scorable data and was equally unexpected to subjects with all three task sets. Furthermore, since a major concern of this study was to investigate the effect of the text manipulation on efficiency of learning, an estimate of amount of learning was required to combine with a measure of reading time. The verification task had the advantage of providing just such a measure.

In designing this experiment, I had conjectured that, in a read-and-answer-questions situation, subjects who had read the elaborated text might evidence more efficient learning when tested on propositions common to both texts, even though these subjects had had to read more material. This expectation was derived from the ideas (Cf. e.g. Greeno, 1977; Ausubel, 1968; Havilland and Clark, 1974) that connections with a person's pre-existing knowledge (what Greeno calls "external connectedness") are an important component of understanding and that learning is most efficient when mediated by understanding. I thought that the particular sorts of elaborative connections (i.e. provision of the purposes of the acts) supplied in the expanded text might prove especially facilitative. This follows from recent theoretical and experimental work (e.g. Schank and Abelson, 1977; Schank and Wilensky, 1978; Mandler and Johnson, 1976; Thorndyke, 1975; Van Dijk and Kintsch, 1977) emphasizing the importance of

goal-directed motifs as organizing principles of well-formed representations of texts. Predictions from these theories accord with the widely held belief that adding "human interest" to a text makes it more readable (Cf. Flesch, 1948).

In addition, I reasoned that if my manipulation were to facilitate processing of the problem rules (i.e. the text elements directly modified by the elaborative material), this "local" effect could be explained by attributing to the additional sentences the role of mnemonics, retrieval cues or aids to chunking. However, if processing of the text aspects not directly involved in the manipulation was also influenced, it would be necessary to invoke some more global cognitive or motivational explanation, perhaps involving the fact that the representation of the text as a whole was better integrated. Such a global effect would be consistent with recent theories of text understanding (e.g. Kintsch and Van Dijk, 1978) emphasizing that texts are approached and processed as wholes.

A second objective of this study was to discover whether the text manipulation would have analogous influence on subjects approaching the text with three different experimentally induced task sets. To review, the sets were: solve the Tea Ceremony puzzle (closed problem), suggest a resolution of the anthropologists' dilemma (open problem), and retell the story in you own words (story). It was felt

that a text manipulation which was shown to have facilitative effects on readers expecting a number of different tasks would be more likely to be applicable to real world situations. The retell story task was selected to exemplify the read and remember or understand set typical of many classrooms and text comprehension experiments. The closed problem set represents one of the most difficult types of understanding activity and one at which even good students are frequently poor (Simon and Hayes, 1976). It should be noted that the Tea Ceremony problem is a particularly difficult problem requiring complex logical inferences. The open problem was chosen because it is similar to much real world "creative" problem solving. In addition, analysis of the kinds of activity involved in open problem solving (Hooke, 1979) indicated that in assigning such a task to subjects one is inducing them to create the kinds of elaborative connections that my text manipulation makes for them. I wanted to corroborate this idea by demonstrating that the open-problem task and the elaborated text would have analogous effects on reading and memory, and also to discover how the two manipulations would interact.

The task of the open-problem solvers involves dealing with exactly the kinds of motivational ideas emphasized in the elaborative sentences. If modern theories of narrative structure are correct, the same can be said for readers whose task is to retell the story. However, if the closed

problem solvers are to perform their task most efficiently, they must ignore such semantic irrelevancies (concerning the features of the elements putatively involved in the ritual) and deal strictly with the logical implications of the puzzle (i.e. the abstract and arbitrary relations among these elements). Indeed, the most well-developed theory of the comprehension of problem instructions, the UNDERSTAND model of Simon and Hayes (1976), predicts that irrelevant material may actually intefere with comprehension. A third objective of this study was to test this prediction by discovering if the elaborative material would hinder the efficiency of puzzle solvers or whether they would be influenced by it in the same way as readers with other purposes. Clearly, the resolution of issues such as these could be applied to the design of instructional text.

As shown in Table I and Figure 1a, reading data indicated that subjects receiving the elaborated text were more likely than their couterparts to spend less time on the second reading of the text than on the first, i.e. to read faster the second time around. (Analysis of variance performed on time per word yielded $F(1, 204) = 4.754$, $p < .05$.) I reasoned that readers will read a paragraph faster the second time when they are satisfied with the understanding they have gained during first reading. The effect of my manipulation on reading behavior, then is consistent with the idea that the addition of semantic

elaboration led readers to form a more coherent, integrated or otherwise understandable representation of the text during first reading, or at least to believe that they had done so. This is confirmed by the fact that rating data indicated that readers of the elaborated text rated it significantly easier than did readers of the other version ($\chi^2(2) = 6.48$, $p < .05$). This effect held true for all three task sets and for each of the eight individual paragraphs.

Of even greater interest is the fact that this is a global effect: the influence of the elaborative sentences carries over to the text paragraphs not involved in the manipulation. That is, readers of the elaborated text appear to be treating paragraphs identical for both versions as easier than do members of the other group. This can be seen in Figure 1b. The mechanism for this "carry over" cannot be determined from these data. However, two possibilities suggest themselves. The first is that the manipulated paragraphs require less effort to understand, thus freeing resources for understanding other aspects of the text. The second possibility is that the additional narrative cohesion or "human interest" of the text induces the reader to engage in more efficient and successful types of processing activities.

The text manipulation was designed to operate by increasing the connectedness between the text elements and

the readers' other knowledge. That this aspect and not some other uncontrolled feature of the added sentences was indeed responsible for the observed effect was corroborated by the fact that the task manipulation designed to increase this kind of connectedness (i.e. the open problem set) had an exactly analogous effect on reading rate. This is shown in Figure 1c.

The final point which needs to be made about the effect of the text manipulation on reading rate is that it holds for all three task sets. (Analysis of variance of reading speeds for the interaction of task set X text version and first or second reading gave $F < 1$.) Thus, closed problem set subjects, whose task, to be performed most efficiently, ought to involve discarding irrelevant semantic features of the problem elements behave as if the addition of such elements made the text easier for them. This result, if generalizable, could have extremely interesting educational implications. However, it is open to question whether the behavior of these subjects with the elaborated text stems from a better understanding of this text or, conversely, simply from a misunderstanding of the closed problem task.

Experimental manipulations which lead to faster processing times frequently also mean diminished performance on memory or comprehension tasks. This was not the case here: the group of readers given the elaborated text, who had spent less time on the second reading, actually

performed somewhat better than their counterparts on three of the four types of sentences. (See Table II.)

Recall that a major concern of this study involved looking at the effect of the text manipulation on learning efficiency. An estimate of efficiency was obtained by dividing each group's mean reading time for the six identical paragraphs of the text by the number of correct responses. (Note that by excluding reading times for the paragraphs actually containing the elaborative material, we are looking only at the global effect of the manipulation, which is likely to be weaker than its local influence.) Such an efficiency score is the kind of measure advocated by Kintsch and Van Dijk as the "only ... adequate measures" of comprehension (1978, p. 373). By this metric readers of the elaborated text were 6% more efficient overall, 12% more efficient on the more sensitive second reading. The attribution of this increase in efficiency to external connectedness is again strengthened by the fact that the open problem set also led to an even larger increased efficiency (Cf. Hooke, 1979).

Disappointingly, the absolute value of the improvement in performance of the elaborated text group is small, 1½% averaging over all sentence types and all task sets. However, Klare (1976) suggests, as a result of extensive analysis and research review, that manipulations which may have small or even negligible effects in experimental contexts, due to the high level of motivation such situations

are likely to induce, may be considerably more potent when applied to real world texts and reading tasks. Moreover, even negligible increases in performance can be impressive if combined with decreases in processing time.

The effects of the text manipulation on performance with the different kinds of sentences involved in the verification task, as well as the interaction of these effects with those of task set are too complex to be dealt with in detail here, and will simply be summarized. A full treatment can be found in Hooke, 1979.

As was noted above, the addition of semantic elaboration facilitated verification performance with three of the four types of sentence (Interaction of sentence type and text version was significant at $p < .05$). Not surprisingly, this effect was strongest for correct verification of paraphrases of the problem rules, i.e. the material directly involved in the elaboration. It is more striking that performance with sentences both explicitly and inferentially relating to text elements in paragraphs which were not manipulated was also facilitated, although to a lesser extent. Again, a more global explanation than simple attribution of the role of retrieval cues etc. to the elaborative material has to be postulated. It should be noted that in all these cases performance of the closed problem group is equally facilitated by the

presence of the elaborative material. This is the case even though their task has been argued (Simon and Hayes, 1976) to involve the stripping away of exactly those irrelevant features which this manipulation introduces. One interpretation of the implications of this seeming paradox is that a manipulation which facilitates greater understanding of material, even of aspects irrelevant to a particular purpose, is likely to facilitate use of the material for any purpose whatever. An alternative interpretation would claim that the facilitation in the performance of the closed problem group attributable to the additional semantic elaboration takes place at the expense of a correct understanding of the nature of the closed problem task. According to this line of argument, some of the closed problem solvers allow themselves to be misled by the additional, innappropriate semantic detail into treating their task as if it can be dealt with pragmatically instead of through a difficult chain of rigorous logic, based on the exact implications of the problem rules, actually required. Thus the apparent increase in efficiency of other aspects of their processing behavior is really specious - a result of their misunderstanding of the actual nature of their assigned task. To my disappointment, this latter interpretation is corroborated by the fact that subjects with all three task sets who read the elaborated text version perform less accurately with the logical inferences derived from the problem rules than do those

reading the other text. This is even more striking in light of the fact that the former have demonstrated more accurate encoding of the raw material for these inferences, the problem rules themselves.

The demonstration that increasing the external connectedness of a text through semantically elaborating certain difficult passages increases reading rate while actually improving memory and comprehension of most aspects of the text has, if replicable, clear educational implications. The fact that these effects are global, i.e. manifest themselves with material not directly altered by the manipulation, increases the attractiveness of using this technique to improve text understanding in practical contexts. That the effect was equally strong in the presence of three different task sets raises hopes for the generality of the phenomenon. However, additional research is warranted to determine why the facilitative effects of this manipulation did not extend to the drawing of difficult logical inferences and under what conditions it would do so.

References

Ausubel, D. P. Educational psychology: A cognitive view. New York: Holt, Rinehart & Winston, 1968.

Flesch, R. A new readability yardstick. Journal of Applied Psychology, 1948, 32, 221-233.

Greeno, J. G. The process of understanding in problem solving. In N. J. Castellan, D. B. Pisoni, and G. R. Potts (Eds.), Cognitive Theory, vol. 2. Hillsdale, N. J.: Erlbaum, 1977.

Havilland, S. and Clark, H. H. What's new? Acquiring new information as a process in comprehension. Journal of Verbal Learning and Verbal Behavior, 1974, 13, 512-521.

Hayes, J. R. and Simon, H. A. Understanding written problem instructions. In L. W. Gregg (Ed.), Knowledge and Cognition. Potomac, Md: Erlbaum, 1974.

Hooke, L. R. The uses of knowledge: The effect of purpose on the understanding of text. Doctoral dissertation, University of Colorado, 1979.

Kintsch, W. and Van Dijk, R. Text comprehension and production. Psychological Review, 1978, 85, 363-393.

Klare, G. R. A second look at the validity of readability

formulas. Journal of Reading Behavior, 1976, 8, 129-152.

Mandler, J. M. and Johnson, N. S. Remembrance of things parsed. Cognitive Psychology, 1976, 8, 111-151.

Schank, R. C. and Abelson, R. Scripts, plans, goals, and understanding. Hillsdale, N.J.: Erlbaum, 1977.

Schank, R. C. and Wilensky, R. A goal-directed production system for story understanding. In D. A. Waterman and F. Hayes-Roth (Eds.), Pattern directed inference systems. New York: Academic Press, 1978.

Simon, H. A. and Hayes, J. R. The understanding process: problem isomorphs. Cognitive Psychology, 1975, 8, 165-190.

Thorndyke, P. W. Cognitive structure in human story comprehension and memory. Rand Paper Series, 1975.

TABLE I.

THE EFFECT OF TASK SET AND TEXT VERSION ON READING SPEED
(IN SECONDS PER WORD)
FOR FIRST AND SECOND READINGS OF TEXT.

Numbers in parentheses refer to speeds on paragraphs identical for the two versions.

	Version					
	Unelaborated			Elaborated		
Reading:	1	2	Mean	1	2	Mean
Task Set						
Open Problem	.380	.381	.381	.406	.357	.381
	(.384)	(.346)	(.365)	(.383)	(.336)	(.359)
Closed Problem	.380	.407	.394	.404	.392	.398
	(.366)	(.331)	(.349)	(.378)	(.332)	(.355)
Story	.411	.490	.450	.384	.397	.390
	(.397)	(.452)	(.424)	(.378)	(.371)	(.374)
All	.390	.426	.408	.398	.382	.390
	(.377)	(.381)	(.379)	(.380)	(.346)	(.363)

TABLE II.

EFFECT OF TEXT VERSION ON VERIFICATION PERFORMANCE WITH FOUR TYPES OF SENTENCE.

	Version			
	Unelaborated		Elaborated	
	Explicit	Inferred	Explicit	Inferred
Not problem relevant (a)	85.7	88.5	86.8	89.8
Problem relevant (b)	89.8	83.4 (76.7)	93.5	82.9 (74.9)

(a) Not involved in manipulation.

(b) Affected by manipulation.

Numbers in parentheses refer to performance on difficult logical inferences.

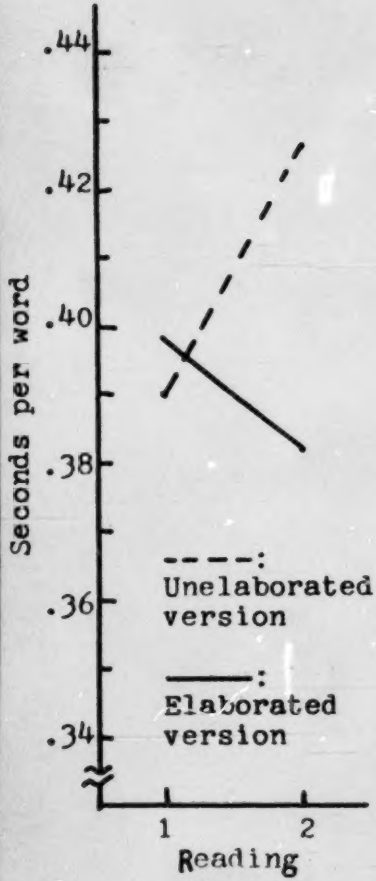

Fig. 1a. Effect of text version on speed of first and second reading.

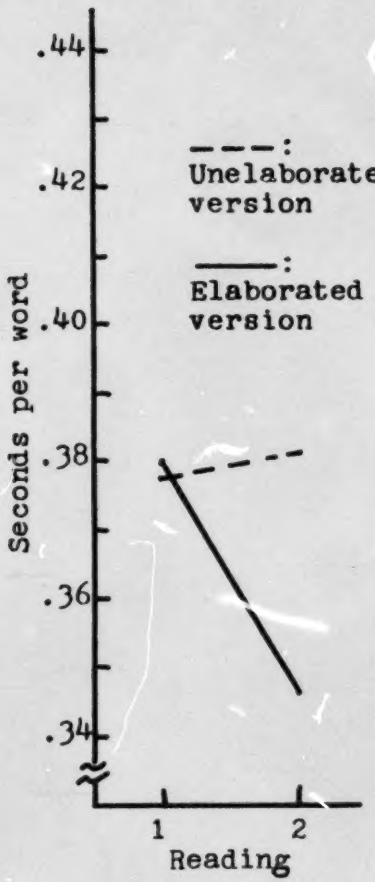

Fig. 1b. Effect of text version on speed of 1st and 2nd reading of non-differing paragraphs.

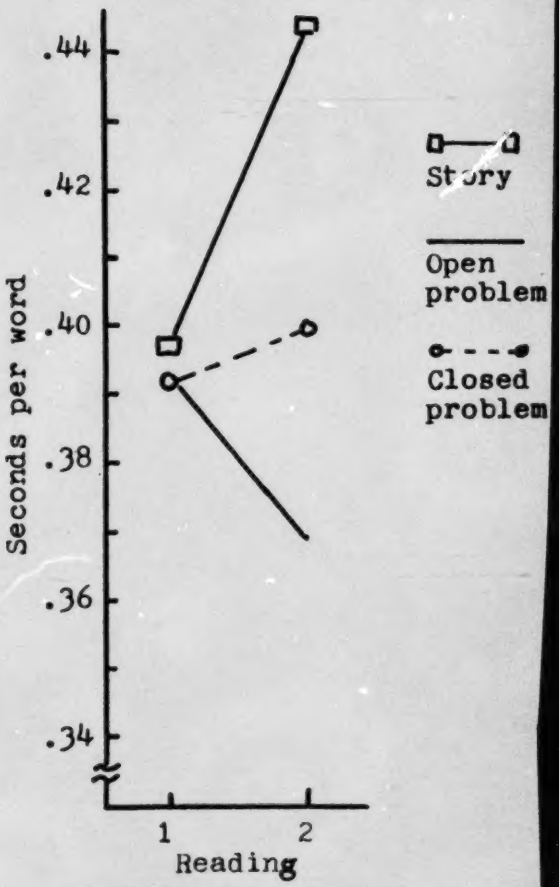

Figure 1c. Effect of task set on speed of first and second reading.

APPENDIX

Text Used in Semantic Elaboration Experiment

Paragraph 1

The inhabitants of Bashnya in the Northern Himalayas ornament their lives with a wide variety of intricate rituals which may seem confusing or even pointless to Western eyes. An especially elegant example is the "Tea Ceremony" which, to the regret of the older generation and several eminent anthropologists, appears to be falling into disuse among the younger generation who find its complexities tedious and unrewarding.

Paragraph 2

The civilized and refined Tea Ceremony is practiced only in specially designated rooms of certain illustrious and venerable inns and involves a host and precisely two guests, neither more nor less. Of the guests, the one who has the higher status in the community is known as "Senior Guest," while the other is "Junior Guest." When the guests, after removing their shoes, enter the chamber, they confront their host, who is seated at a lacquered table and simultaneously performing five services for them. (The numbers three and five along with seven are held to have mystical significance in this Eastern culture, as in many others.)

Paragraph 3U

Each of the services or tasks, as is in keeping with the rather rigid ideology of the Himalayas, has a certain degree of nobility associated with it. These are the five tasks and how they relate to each other in nobility: Reciting poetry is more noble than pouring tea. Pouring tea is more noble than passing rice cakes. Passing rice cakes is more noble than fanning the flames. Fanning the flames is more noble than stoking the fire.

Paragraphs 3E and 4E

Each of the services or tasks, as is in keeping with the rather rigid ideology of the Himalayas, has a certain degree of nobility associated with it. These are the five tasks and how they relate to each other in nobility: Reciting poetry is more noble than pouring tea. Poetry provides purely spiritual nourishment; tea does uplift the spirits, but is mainly food for the body. Pouring tea is more noble than passing rice cakes. Tea is for both body and soul; rice cakes nourish only the body. Passing rice cakes is more noble than fanning the flames. It is considered more important to warm the body from within than from without. Fanning the flames is more noble than stoking the fire. The flames are likened to the spirit of the fire; stoking involves only maintaining the fire's food supply and thus is less noble.

Paragraph 5

In the course of the ceremony, any one of the three participants may say to another: "Honored Sir, may I take the burden of this tedious task from your shoulders and perform it in place of you?" If the requester has asked for a task which is permissible according to the ceremony rule, he is given that task to perform until another requests it of him or the ceremony comes to an end. Tradition requires that, at any given time, each task must be performed by one and only one person. Thus, at the moment when one participant takes up a new task, the previous participant ceases to perform it. The rules which determine what tasks are permissible to request have been fixed for centuries.

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Paragraph 6D

A person may request of another only the least noble of the tasks which the other is performing. Furthermore, if a person is performing any services, he may not request a task nobler than the least noble task he is performing. (If a participant is not performing any task, he may take on himself the least noble of the tasks being performed by either of his companions.)

Paragraph 6E

A participant must not appear to seek to elevate his own nobility or lower that of one of the others. A person may therefore request of another only the least noble of the tasks which the other is performing. Furthermore, if a person is performing any services, he may not request a task nobler than the least noble task he is performing, as this would be considered social climbing, an unpardonable breach of etiquette. (If a participant is not performing any task, he may take on himself the least noble of the tasks being performed by either of his companions.)

Paragraph 7

Etiquette requires that, by the time the Tea Ceremony is completed, the Senior Guest will be performing all five of the tasks (as the host was in the beginning) and the host and Junior Guest will be performing none. The duty of a participant in the Tea Ceremony is to bring about this situation with the fewest number of transfers of tasks from one person to another and with no violations of the ceremony rules.

Paragraph 8

While the rules controlling the Tea Ceremony are quite complex, the duties of the participants are extremely clearcut. Unfortunately, the duty of the anthropologists who study this part of the world is not at all clearcut. The Tea Ceremony of Boshnya is considered one of the finest examples of "ritualization" of a belief system in the world, yet it is falling into neglect because of the apathy and even ridicule of the Westernized younger generation. Anthropologists are terribly anxious to have the ceremony preserved in its living form, yet they hesitate to intervene directly, fearing that they will alter the ceremony beyond recognition through their interference.

Paragraph 9

These anthropologists, who do have adequate financial means at their disposal, face the problem of finding a way to insure the continuance of the Tea Ceremony without imposing on it their own ideas about its nature.

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